CANMET

Canada Centre for Mineral and Energy Technology

Centre canadien de la technologie des minéraux et de l'énergie

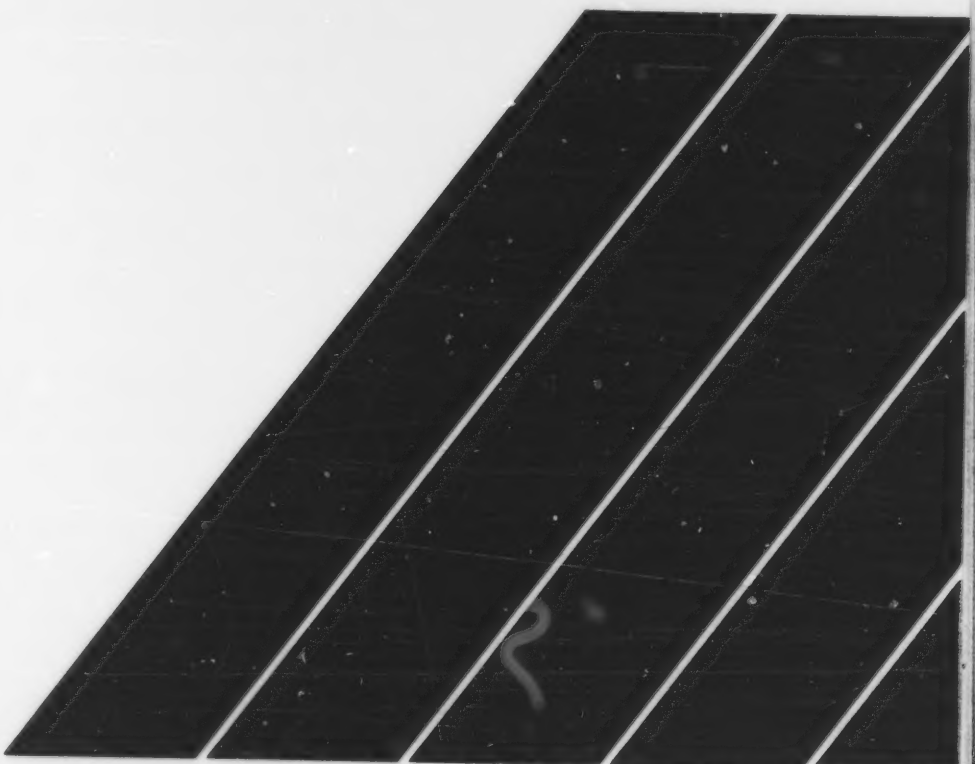
Mining Research Laboratories

Laboratoires de recherche minière

AN OVERVIEW OF MINING RESEARCH IN CANADA BASED ON MRL's "INDEX OF MINING TECHNOLOGY PROJECTS"

R. Boyle & J.E. Udd

MRL 91-056(TR) Sept. 1991



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MICROMEDIA

AN OVERVIEW OF MINING RESEARCH IN CANADA BASED ON MRL's "INDEX OF MINING TECHNOLOGY PROJECTS"

by

R. Boyle[1] and J.E. Udd[2]

ABSTRACT

Based on a study of MRL's 1990 "Index of Mining Technology Projects" all of the mining research projects known to be underway in Canada have been categorized by organization type: mines, universities, private sector, public sector and the Mining Research Laboratories (MRL) and by subject areas: administration, feasibility, surface technology, design, equipment, development, production, materials handling, services, ground control, high technology and processing. In this report we present the distribution of projects done by the various kinds of organizations for all subject areas and show the percentage of projects done for each category according to organization type. The report also presents a comparison of the Mining Research Laboratories research projects with those of other types of organization.

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Key words: INDEX, mining research, universities, public sector, private sector, mines, administration, feasibility, surface technology, design, equipment, development, production, materials handling, services, ground control, high technology.

UN SURVOL DE LA RECHERCHE MINIERE AU CANADA BASEE SUR LE REPERTOIRE DES PROJETS EN TECHNOLOGIE MINIERE DES LRM

par

R. Boyle[3] et J.E. Udd[4]

Résumé

Basé sur une étude du répertoire des projets en technologie minière des LRM, tous les projets de recherche connus et en cours au Canada ont été classés en catégories pour chaque type d'organisation: les mines, les universités, le secteur privé, le secteur public et les Laboratoires de recherche minière. Les projets ont été ainsi classés par sujets d'intérêt: administration, faisabilité, technologie de surface, conception, équipement, développement, production, manutention des matériaux, services, soutènement, technologie de pointe et minéralurgie. Dans ce rapport, nous présentons la distribution des projets réalisés par les différentes organisations dans chaque catégorie et montrons le pourcentage des projets effectués dans chaque catégorie par type d'organisation. Le rapport présente une comparaison entre les projets de recherche des Laboratoires de recherche minière et ceux des autres organisations.

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Mots clés: Répertoire, recherche minière, universités, secteur public, secteur privé, mines, administration, faisabilité, technologie de surface, conception, équipement, développement, production, manutention des matériaux, services, soutènement, technologie de pointe, minéralurgie.

TABLE OF CONTENTS

ABSTRACT i

RESUME ii

INTRODUCTION 1

CATEGORIES 2

DATA 5

INTERPRETATION OF RESULTS 8

TABLES

No.

1 Percentage of projects by categories (each category adds up to 100%) 6

2 Percentage of projects by organization (each organization adds up to 100%) 7

FIGURES

No.

1 Percentage of all projects by category 11

2 Percentage of all projects by organization 12

3 Percentage of projects by categories 13

4 Category 1 – Administration 14

5 Category 2 – Feasibility 15

6 Category 3 – Surface Technology 16

7 Category 4 – Design 17

8 Category 5 – Equipment 18

9 Category 6 – Development 19

10 Category 7 – Production 20

11 Category 8 – Materials Handling 21

12 Category 9 – Services 22

13 Category 10 – Ground Control 23

14 Category 11 – High Technology 24

15 Mines projects by categories 25

16 Universities projects by categories 26

17 Public sector projects by categories 27

18 Private sector projects by categories 28

19 MRL projects by categories 29

20 Comparison by categories Mines – MRL 30

21 Comparison by categories Universities – MRL 31

22 Comparison by categories Public sector – MRL 32

23 Comparison by categories Private sector – MRL 33

INTRODUCTION

The information in this report was taken from CANMET / MRL's 1990 "Index of Mining Technology Projects". The Index is a directory of all known mining research projects done by various organizations across Canada. The information in the Index was collected and compiled by the staff of the Mining Research Laboratories. In the "Index" each project is assigned to the category of the organization doing the work, namely: mines; universities; private sector and public sector. Each project is also assigned to a maximum of two research subject areas. The Index presently has twelve such categories. These are: administration, feasibility, surface technology, design, equipment, development, production, materials handling, services, ground control, high technology and processing. The category "processing" is not completely represented in the Index since CANMET's Mineral Sciences Laboratories division now produces a similar Index which includes this area of work. The category will be discontinued in future editions of MRL's Index.

The 1990 "Index of Mining Technology Projects" includes 281 participants and 833 individual projects. As mentioned, some projects are listed in two categories. For example, a project may be high technology and also ground control. In this case the project is counted twice, once in high technology and once in ground control. On this basis, the total number of project listings is 1,439.

CATEGORIES

Twelve areas of mining research are included in the "Index of Mining Technology Projects". These are: Administration, Feasibility, Surface Technology, Design, Equipment, Development, Production, Materials Handling, Services, Ground Control, High Technology and Processing. The categories are defined as follows:

1 – ADMINISTRATION:

MINE ADMINISTRATION includes manpower training and development, the health and safety of employees, management organization, voice communications, data communications, remote monitoring and labour relations.

2 – FEASIBILITY

MINE FEASIBILITY includes economic studies, mine evaluations, cost estimations and other projects undertaken to determine the potential success of major capital expenditures to develop a new mine, rehabilitate an old mine, or expand an existing mine for increased production.

3 – SURFACE TECHNOLOGY

SURFACE TECHNOLOGY includes prospecting, exploration, sampling, modelling, geostatistics, hydrology and geotechnology. It will also include projects dealing with environmental subjects such as waste management, dewatering and other site work such as roads, bridges, dams and runways.

4 – DESIGN

MINE DESIGN includes selecting stope and pillar patterns and mining methods for new mines or for existing operations that are to be modernized or expanded. The category also includes planning, scheduling and grade control.

5 – EQUIPMENT

EQUIPMENT includes equipment design, selection and maintenance as well as installed and consumable supplies.

6 – DEVELOPMENT

DEVELOPMENT includes methods of advancing mine and stope access headings leading to the fragmentation and removal of the muck to the haulage system.

7 – PRODUCTION

PRODUCTION includes operational topics such as fragmentation, blast pattern design, drilling methods, explosives and all other matters connected to preparing a block of ore, either a stope or a pillar, for drilling and blasting and removal of the fragments to the haulage system.

8 – MATERIALS HANDLING

MATERIALS HANDLING includes the movement of fragmented material, from stope or development heading, via loading/transportation systems, grizzlies, rock–breakers, ore passes, crushers, surge and storage bins and loading pockets to surface.

9 – SERVICES

MINE SERVICES include ventilation, surveying, compressed air, dewatering systems, air heating, hoisting plant (hoist, headframe, shaft conveyances and all shaft installations) and electrical supply, control and distribution.

10 – GROUND CONTROL

GROUND CONTROL includes rock mechanic studies, ground support mechanisms and ground support preparation, placement and installation.

11 – HIGH TECHNOLOGY

HIGH TECHNOLOGY includes computers, robotics, water jets or other new and innovative systems.

12 – PROCESSING

PROCESSING includes general milling operations, mill recoveries, concentrate grades, reagent consumption, etc., as well as in–situ and heap leaching operations on surface or underground, and recovering economic values from tailings and waste dumps.

DATA

A compilation of the data by category and organizational types was done and the results are summarized in Tables 1 and 2.

Table 1 percentage of projects by categories (each category adds up to 100%).

CATE-GORY	Mines	Univer.	Public Sector	Private Sector	MRL	# of projects	%
1	13	7	7	46	27	139	100
2	19	51	3	20	7	73	100
3	15	36	2	32	15	117	100
4	22	36	11	21	10	134	100
5	23	18	21	28	10	149	100
6	35	46	15	4	0	46	100
7	44	28	12	12	4	92	100
8	41	11	5	34	9	44	100
9	30	7	7	38	18	112	100
10	27	40	8	16	9	309	100
11	33	34	15	14	4	184	100
12	42	35	0	20	3	40	100
	%	%	%	%	%	1,439	%

Table 2 percent of projects by organization type (each organization type adds up to 100%).

CATE-GORY	Mines	Univer.	Public Sector	Private Sector	MRL	%
1	5	2	7	19	24	%
2	4	9	1	4	3	%
3	4	10	1	11	11	%
4	8	12	10	8	8	%
5	9	6	23	12	10	%
6	4	5	5	1	0	%
7	10	6	8	3	3	%
8	5	1	1	4	3	%
9	9	2	6	13	13	%
10	22	29	18	15	19	%
11	16	15	20	7	5	%
12	4	3	0	3	1	%
	100	100	100	100	100	%
# of projects	379	427	140	340	153	1,439

INTERPRETATION OF RESULTS

Figure 1, derived from Table 1, shows the percentage of the "Index of Mining Technology Projects" in each category. Ground Control is by far the most important; 22% of all projects have a ground control content.

Figure 2, derived from Table 2, represents the percentage of the "Index of Mining Technology Projects" done by the various types of organizations; i.e. mines, universities, private sector, public sector and CANMET's Mining Research Laboratories (MRL). MRL and the public sector account for 11% and 10% of all projects done, respectively. In the "Index of Mining Technology Projects" MRL is included as a part of the Public Sector. For this study they were separated, thus the total for the Public Sector is 21%.

Figure 3 , derived from Table 1, shows a vertical stack bar of the percentages of projects done by each of the organization types for each category. This figure is the summary of figures 4 to 14. Figures 4 to 14, derived from Table 1, show the percentage of each category done according to organizational type. These figures (4 to 14) simply show the distribution in percent of the work load per organization type.

Figures 15 to 19, derived from Table 2, represents the distribution of the work load of each category for the type of organization. Figure 19 shows MRL having no development. Since, MRL now has a new high technology experimental mine in Val d'Or, however, some development projects will now be initiated from this new laboratory.

Figures 20 to 23 derived from Table 2, are the comparisons between MRL and each of the other organization types i.e. mines, universities, private sector and the public sector.

Figure 20 is the comparison between the mines and MRL. The most outstanding differences are in category 1: Administration. Where mining companies performs 5% of all their projects in the Administration category, MRL does 24% of all their projects in this category. MRL, unfortunately lags in high technology projects. This is partly explained by the high costs of such projects, the long term research (3 to 5 years) involved and the new priorities of MRL towards cost recovery and joint ventures with the mining industry. As mentionied, however, in the near future with MRL's new high technology experimental mine, MRL will be much more involved in high technology projects in various fields such as development and production (fragmentation in particular). This deficiency in research balance will soon be corrected.

Figure 21 compares universities and MRL. As with figure 20, administration and high technology projects are the major differences. Services projects are higher in MRL.
Figure 22 compares MRL with the public sector; the major differences are in the categories of administration, high technology and equipment. MRL has a larger percentage of surface technology projects.

Figure 23 compares MRL and the private sector. This figure is very conclusive. There are

virtually no differences between MRL and the private sector. This reflects the long tradition of applied research in MRL and the new policies of the Federal Government, in terms of cost recovery and joint ventures research projects with the mining industry.

PERCENTAGE OF ALL PROJECTS BY CATEGORIES
Total of 1,439 projects

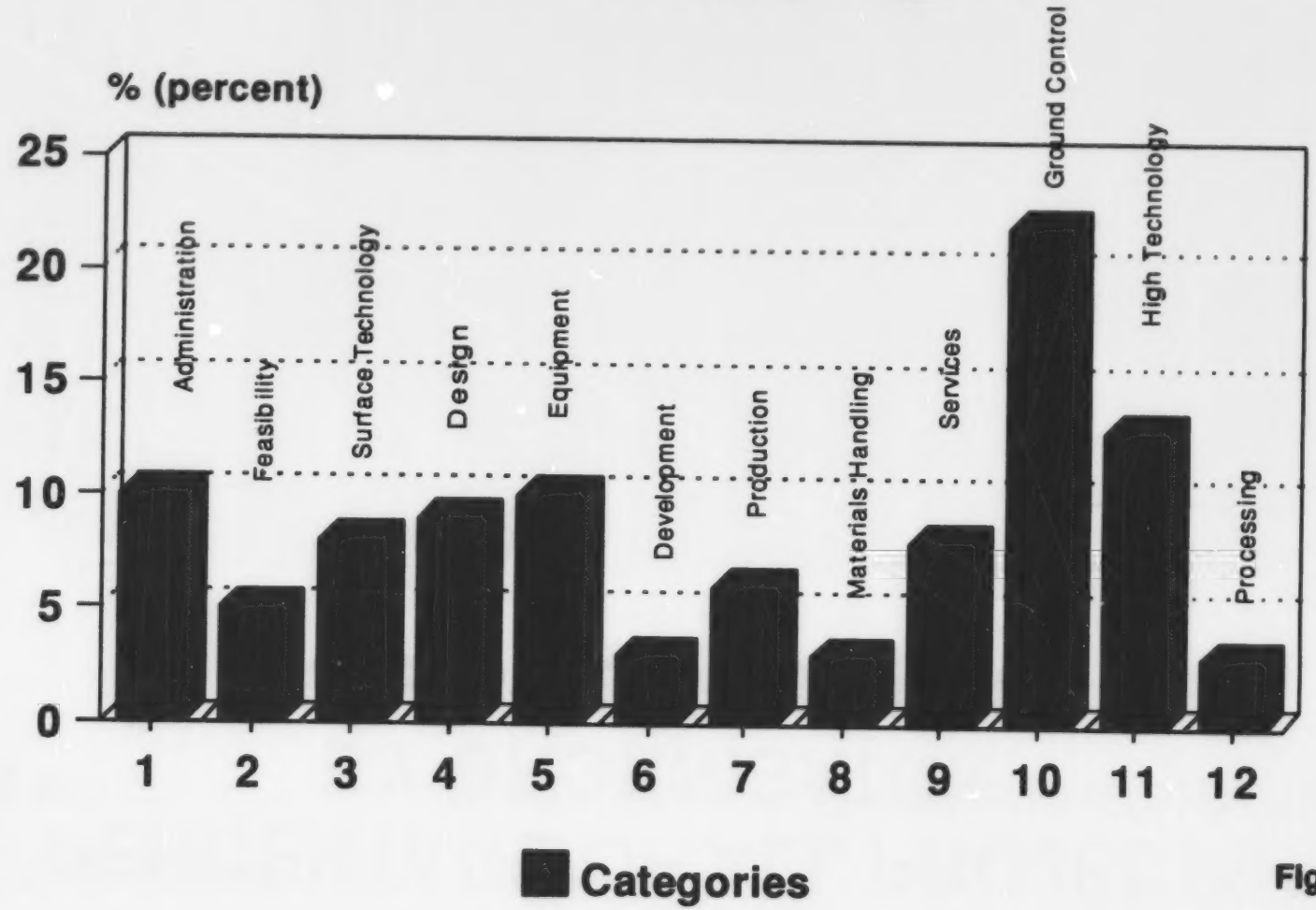


Fig. 1

PERCENTAGE OF ALL PROJECTS BY ORGANISATON
Total of 1,439 projects

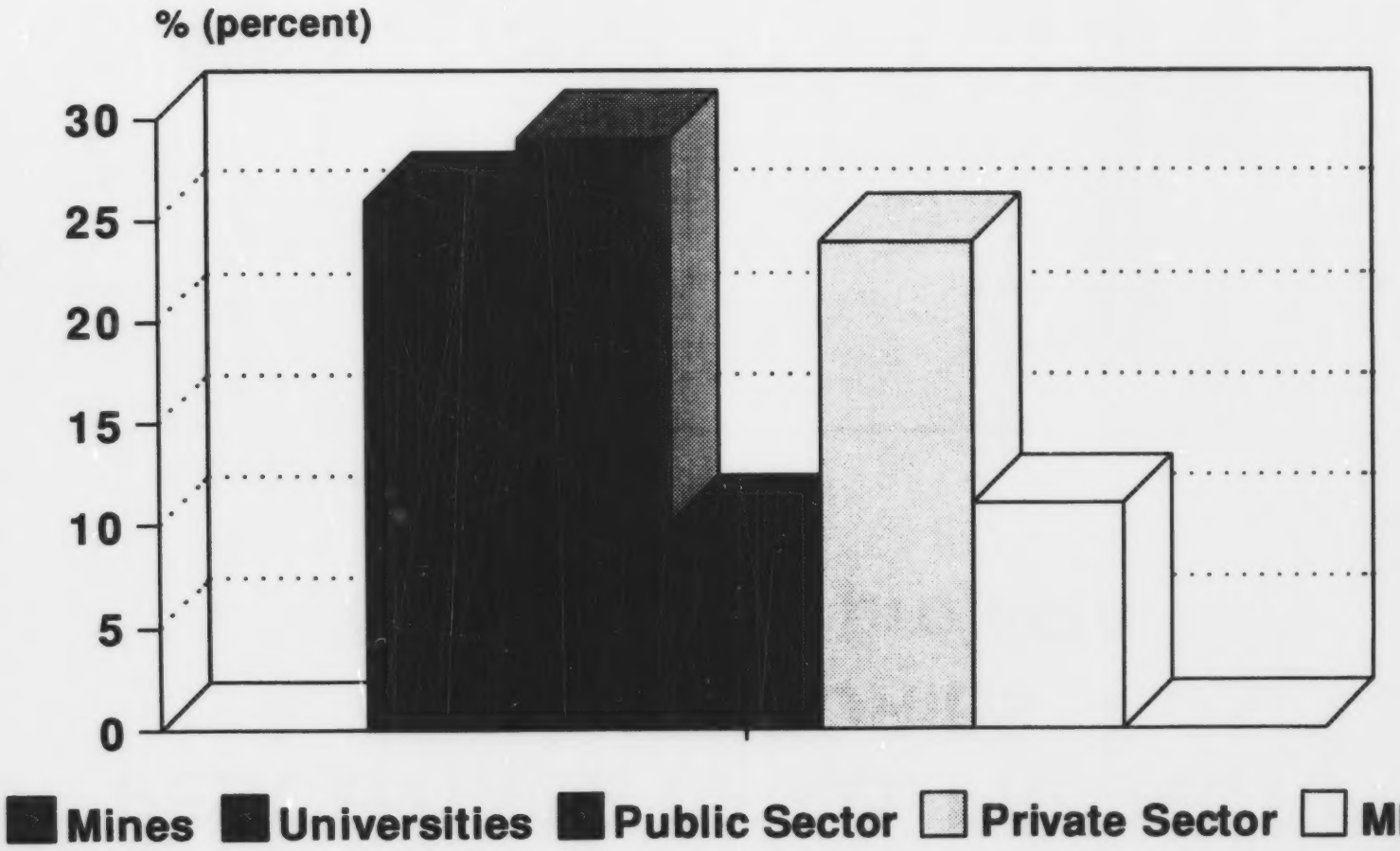


Fig. 2

PERCENT OF PROJECTS BY CATEGORIES

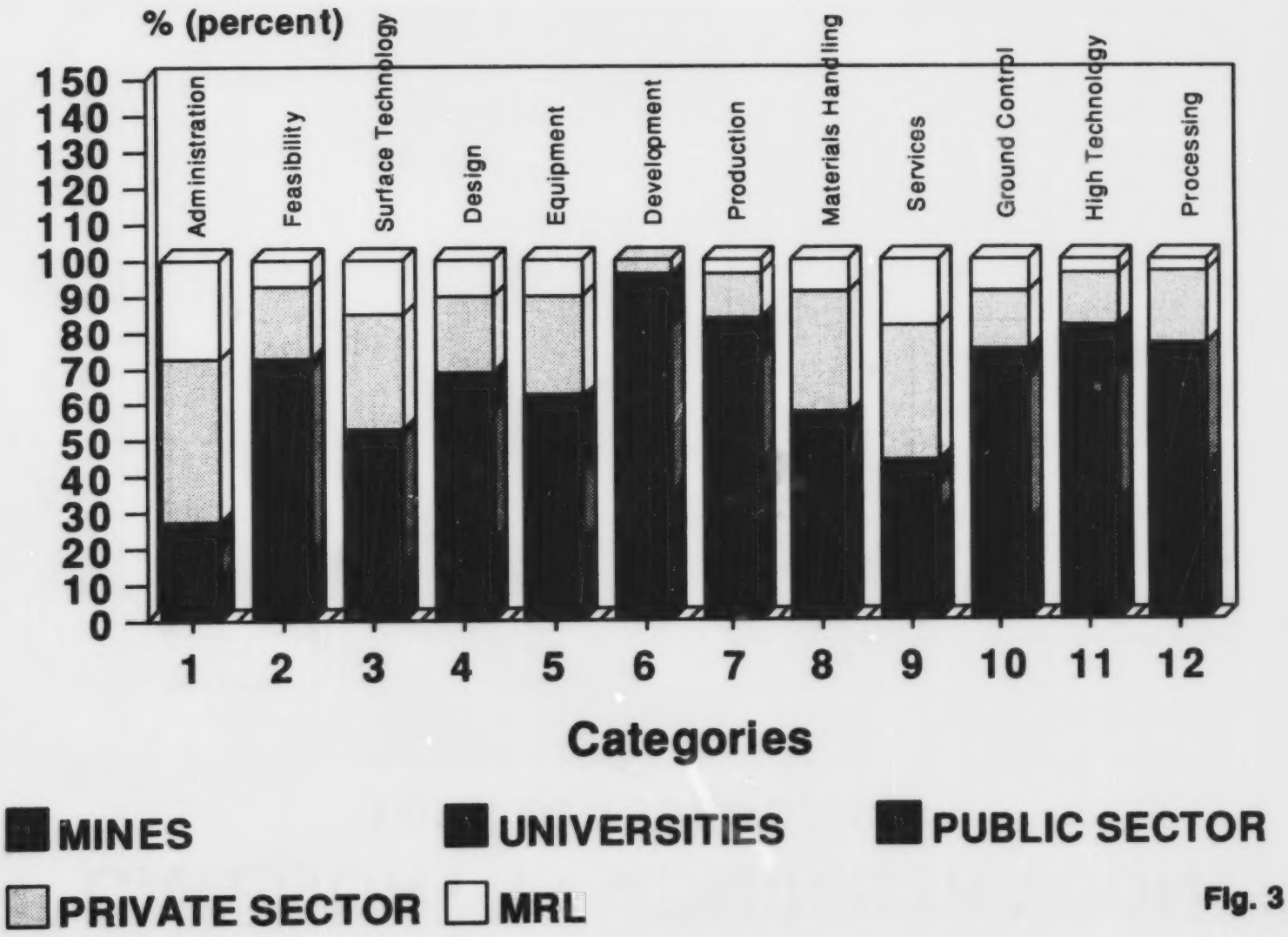


Fig. 3

CATEGORY 1 - ADMINISTRATION
Total of 139 projects

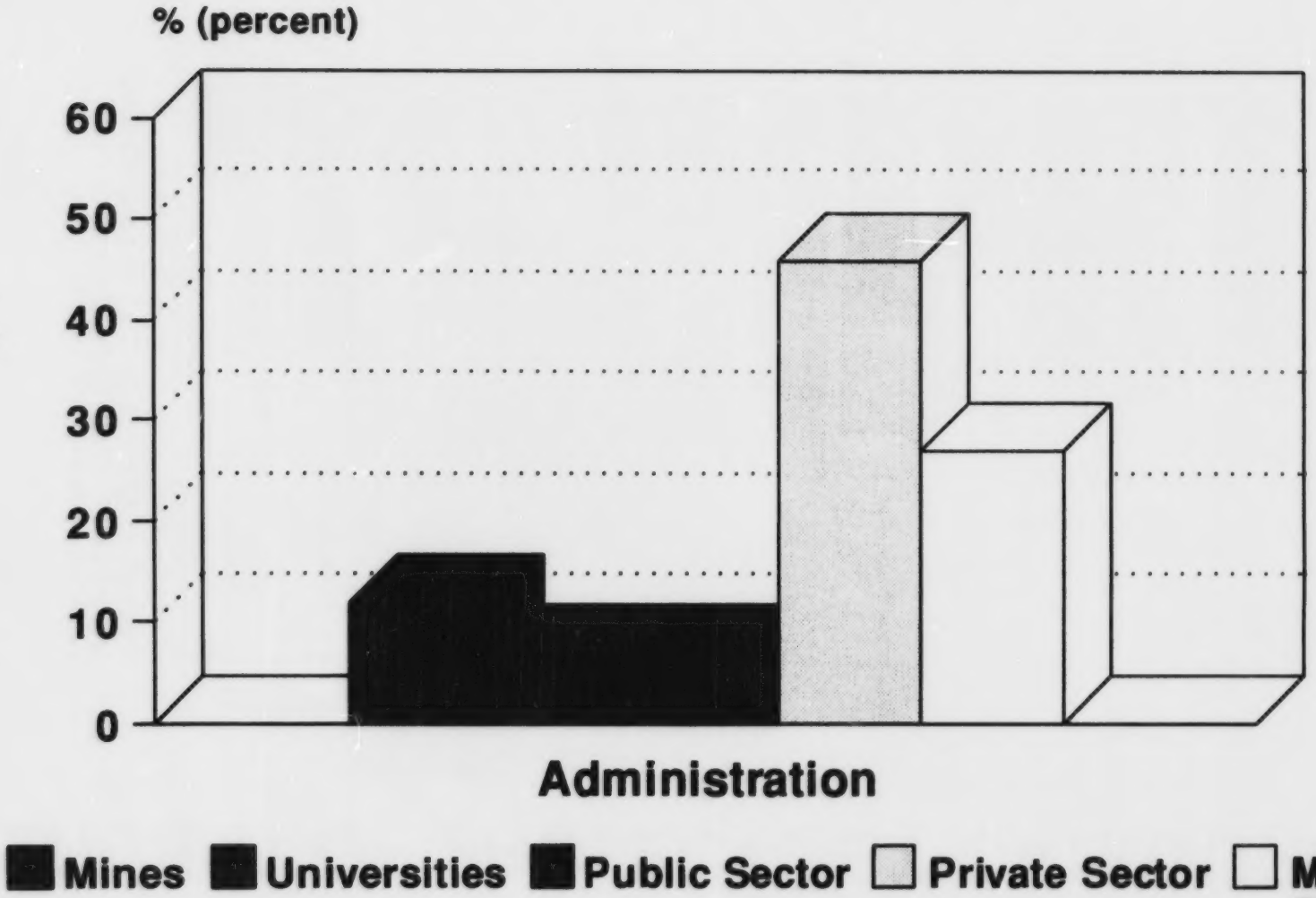


Fig. 4

CATEGORY 2 - FEASIBILITY

Total of 73 projects

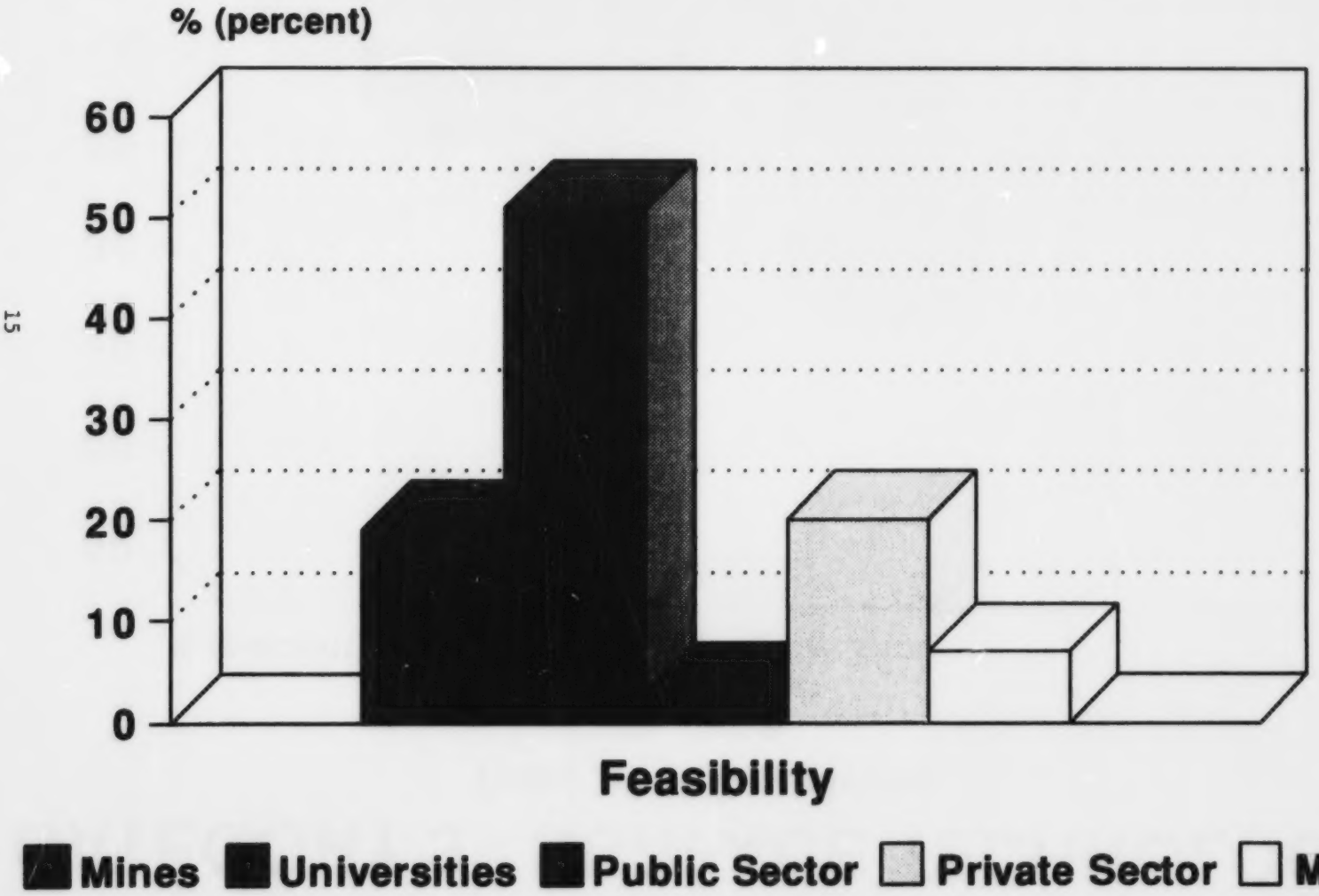


Fig. 5

CATEGORY 3 - SURFACE TECHNOLOGY

Total of 117 projects

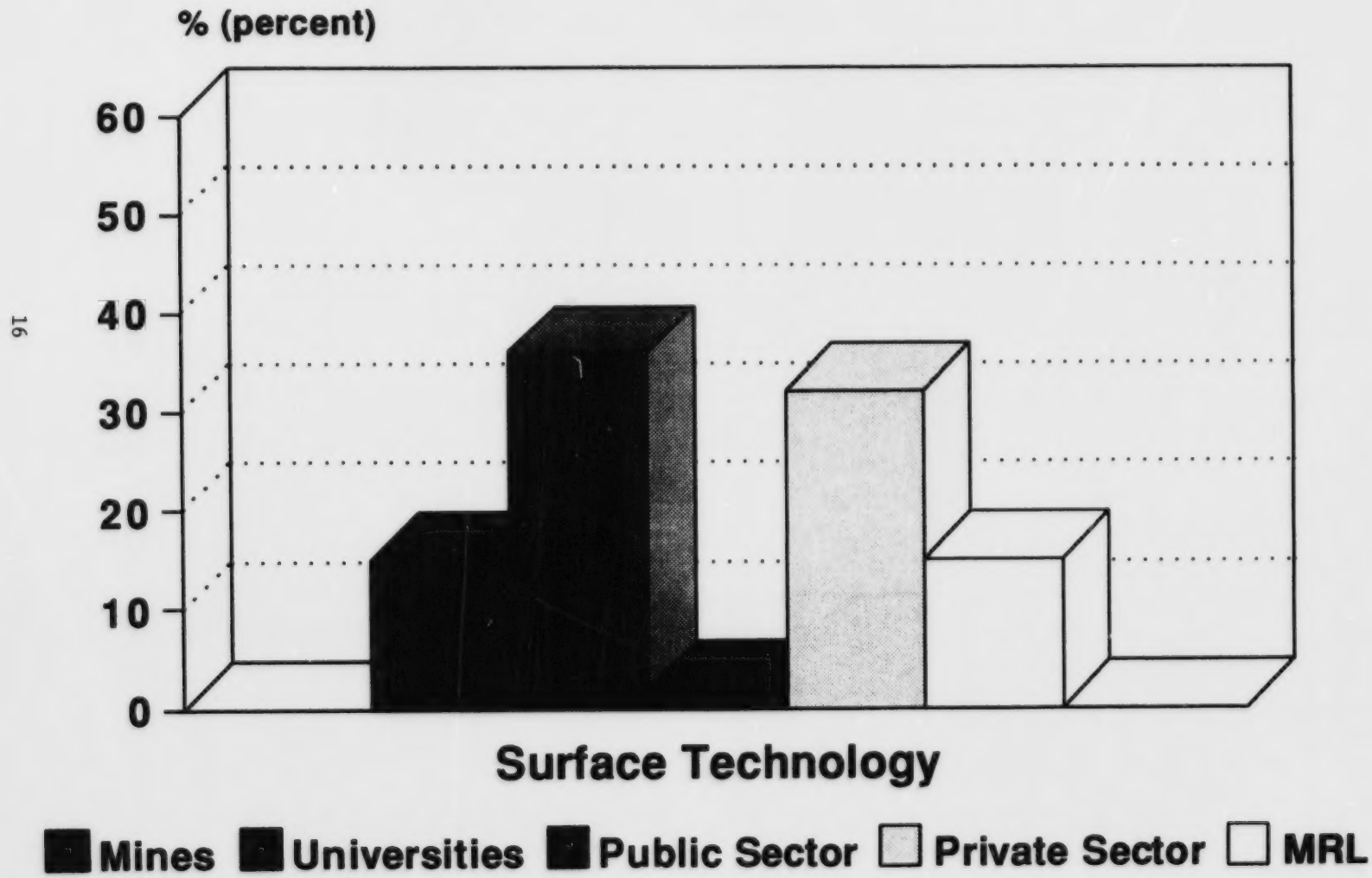


Fig. 6

CATEGORY 4 - DESIGN

Total of 134 projects

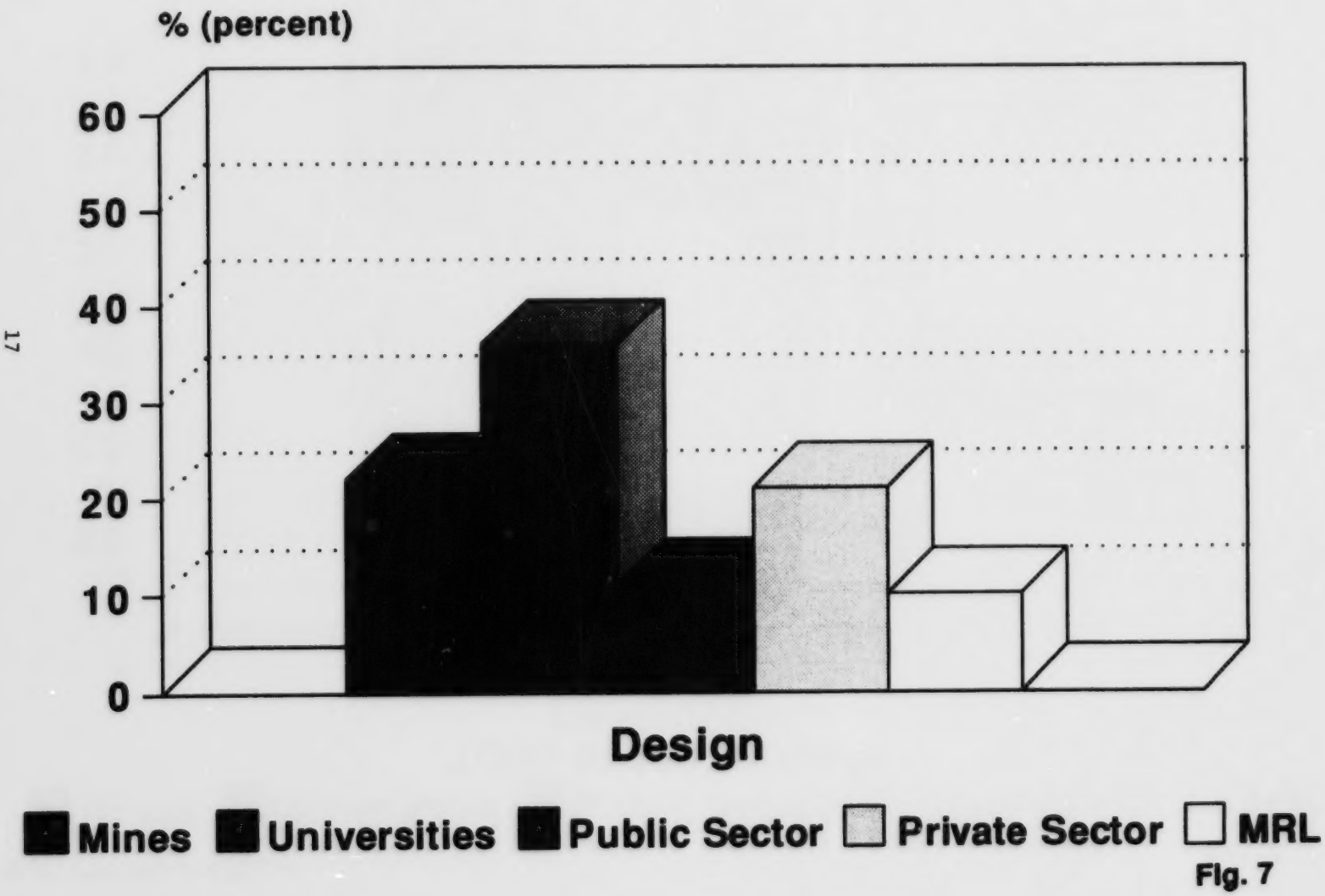


Fig. 7

CATEGORY 5 - EQUIPMENT

Total of 149 projects

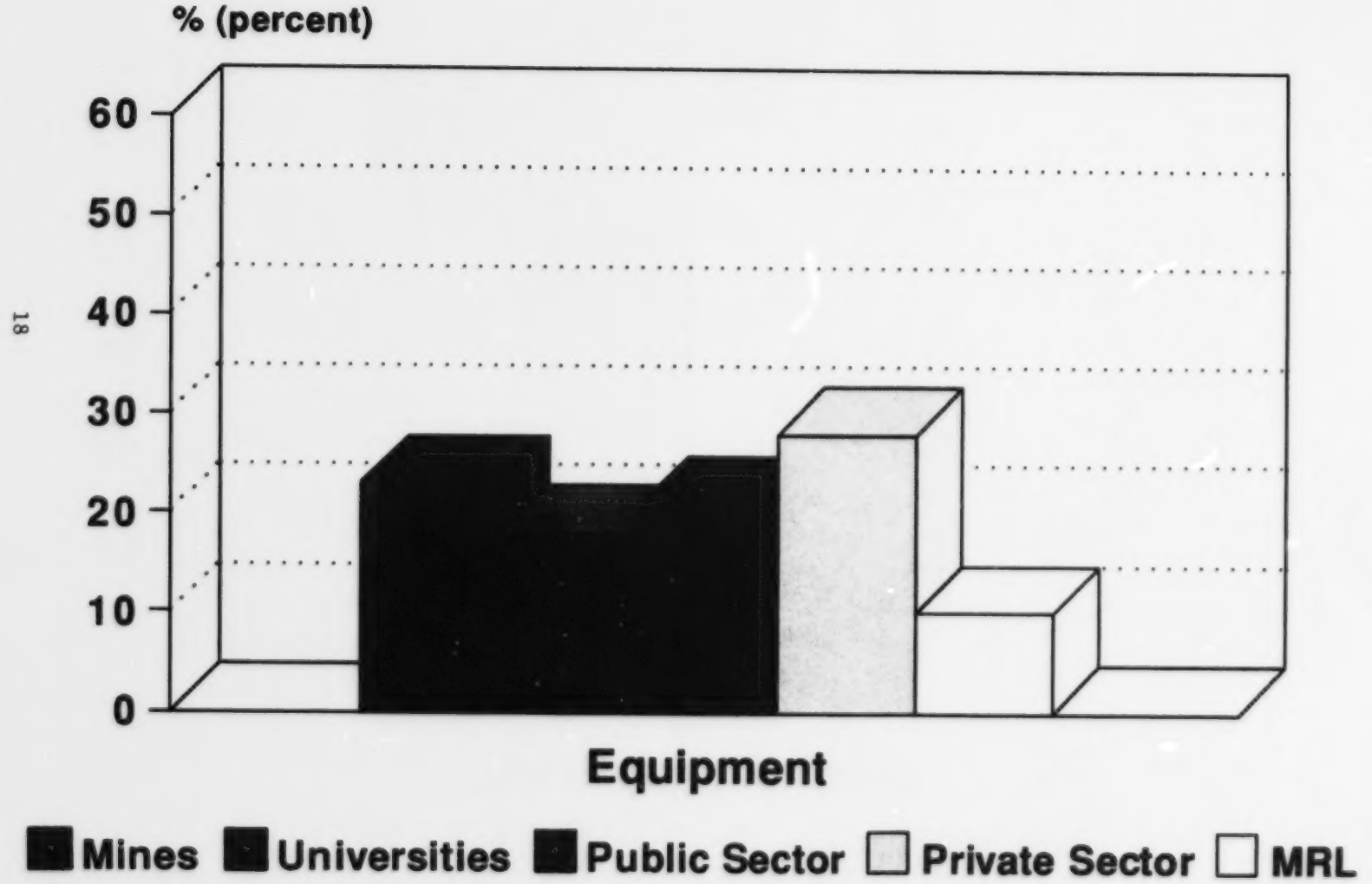
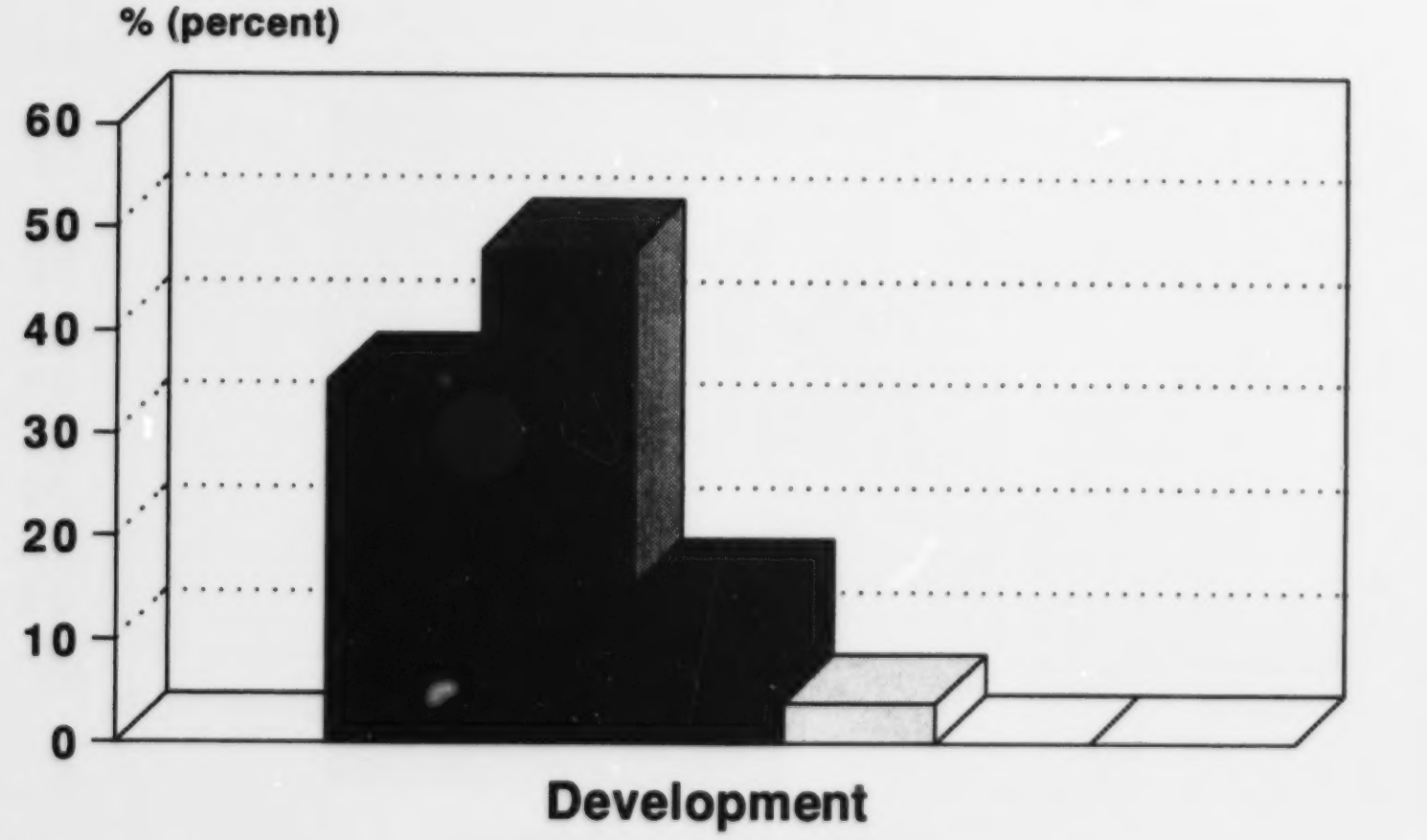


Fig. 8

CATEGORY 6 - DEVELOPMENT

Total of 46 projects



* MRL has no projects

Fig. 9

CATEGORY 7 - PRODUCTION

Total of 92 projects

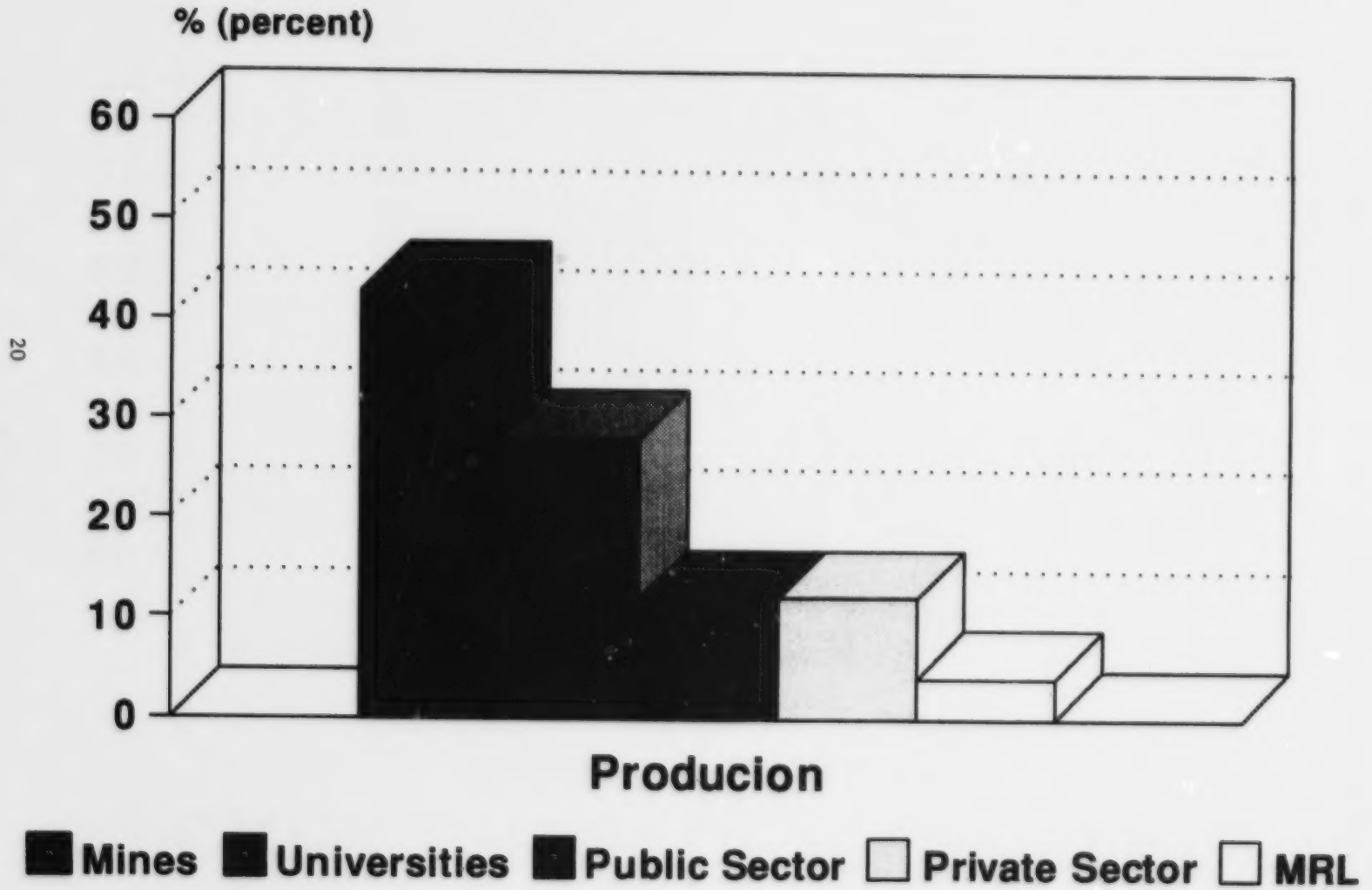


Fig. 10

CATEGORY 8 - MATERIALS HANDLING

Total of 44 projects

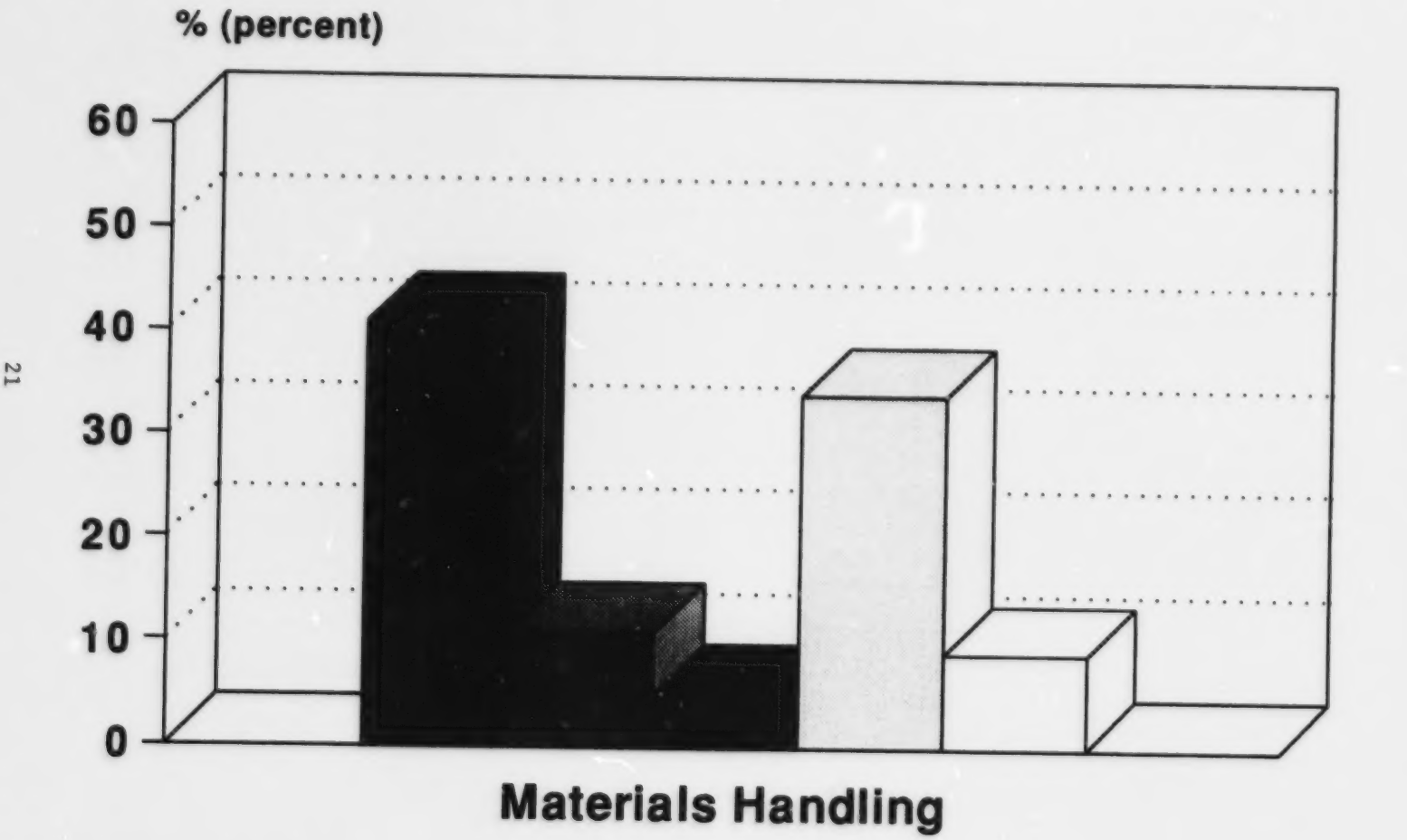


Fig. 11

CATEGORY 9 - SERVICES

Total of 112 projects

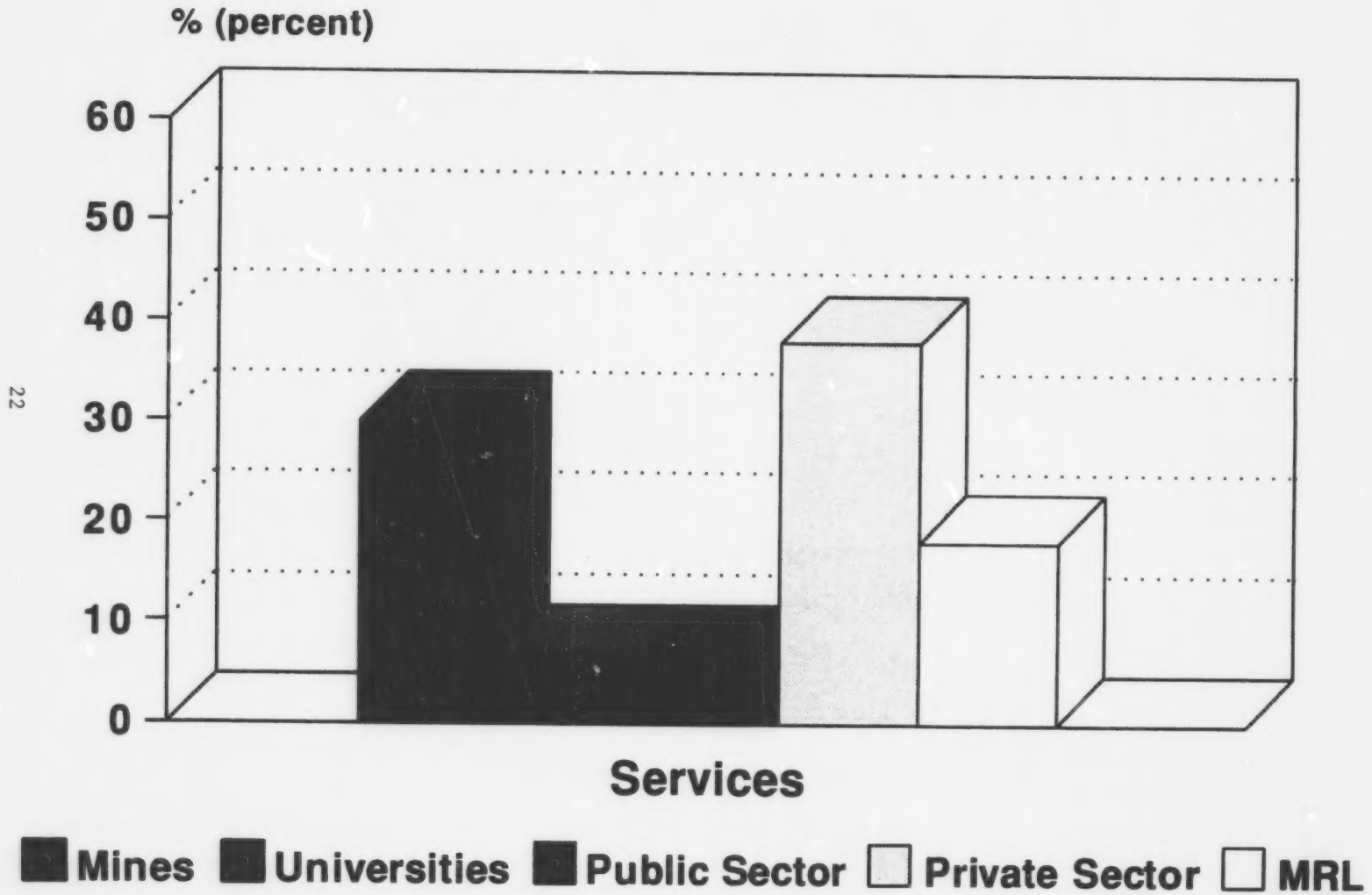


Fig. 12

CATEGORY 10 - GROUND CONTROL

Total of 309 projects

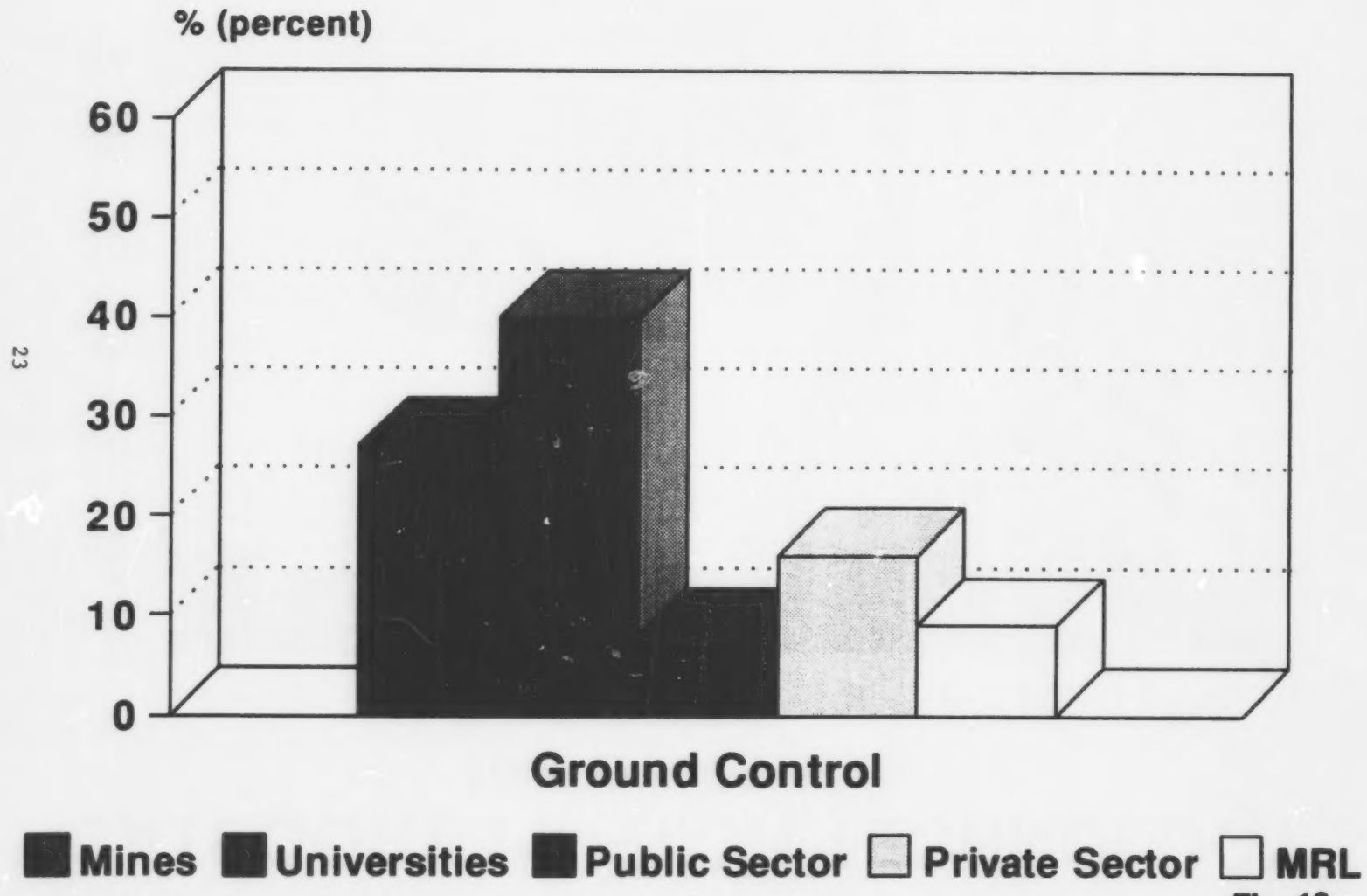


Fig. 13

CATEGORY 11 - HIGH TECHNOLOGY

Total of 184 projects

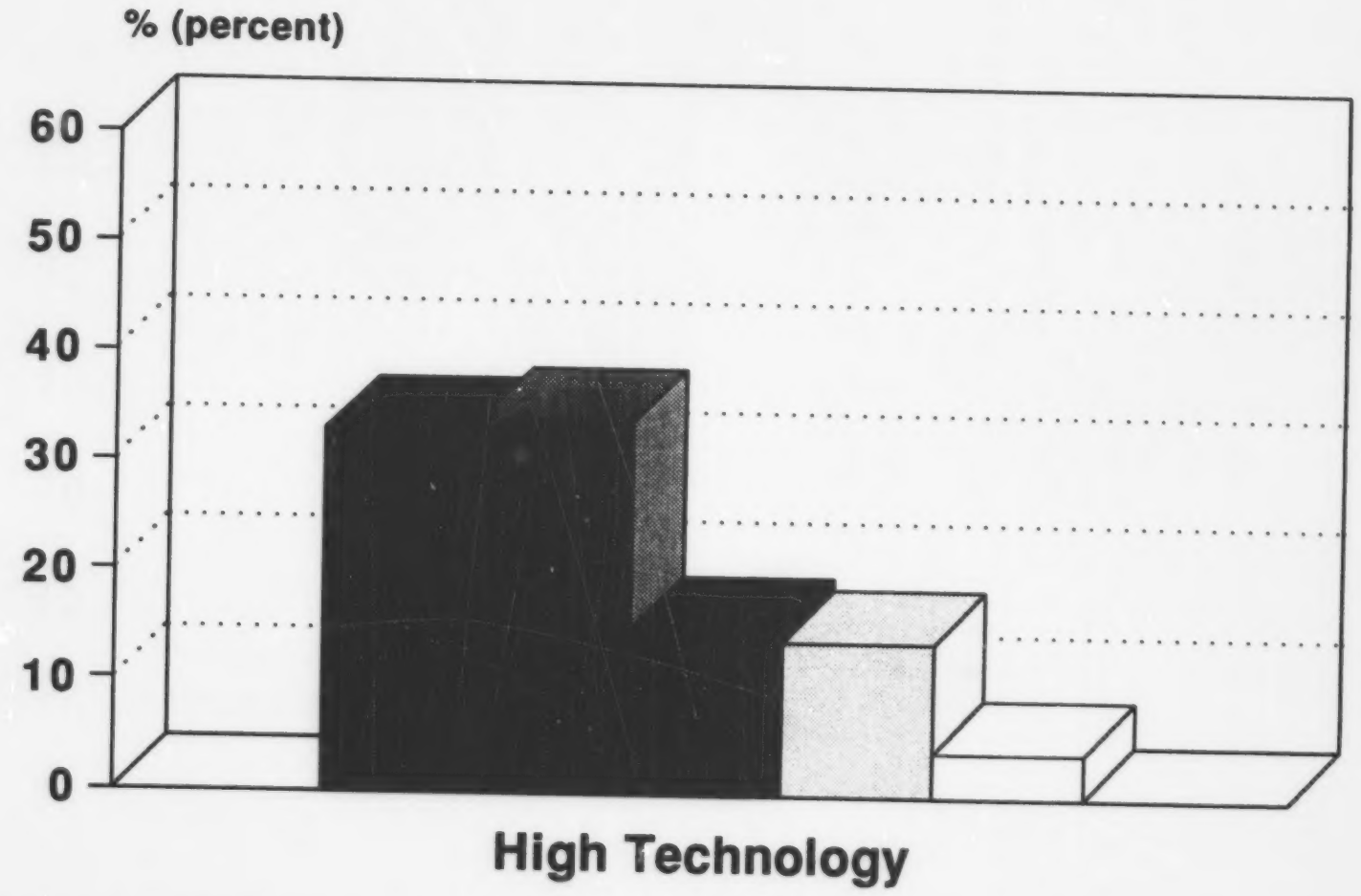


Fig. 14

MINES

PROJECTS BY CATEGORIES

Total of 379 projects

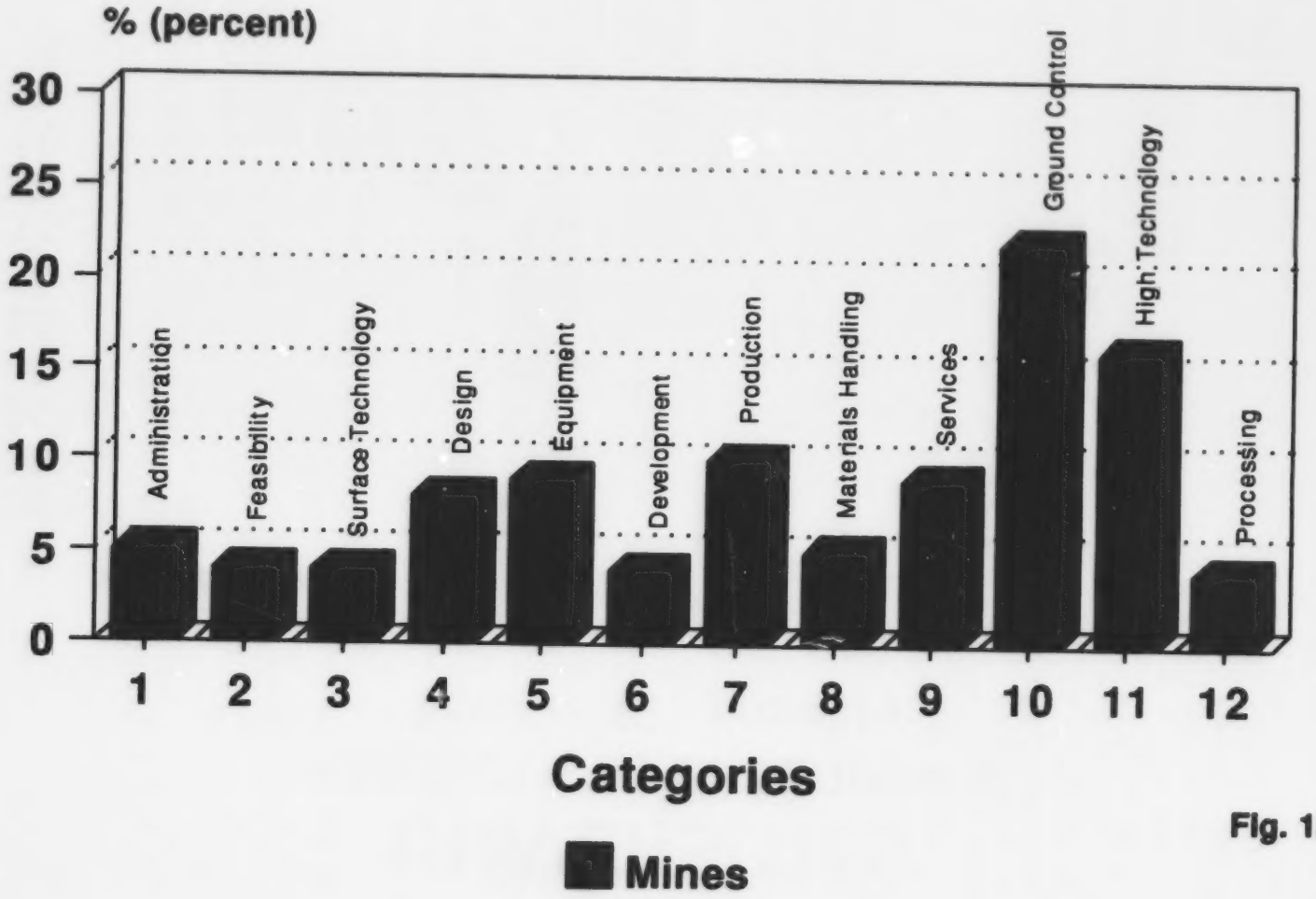


Fig. 15

UNIVERSITIES

PROJECTS BY CATEGORIES

Total of 427 projects

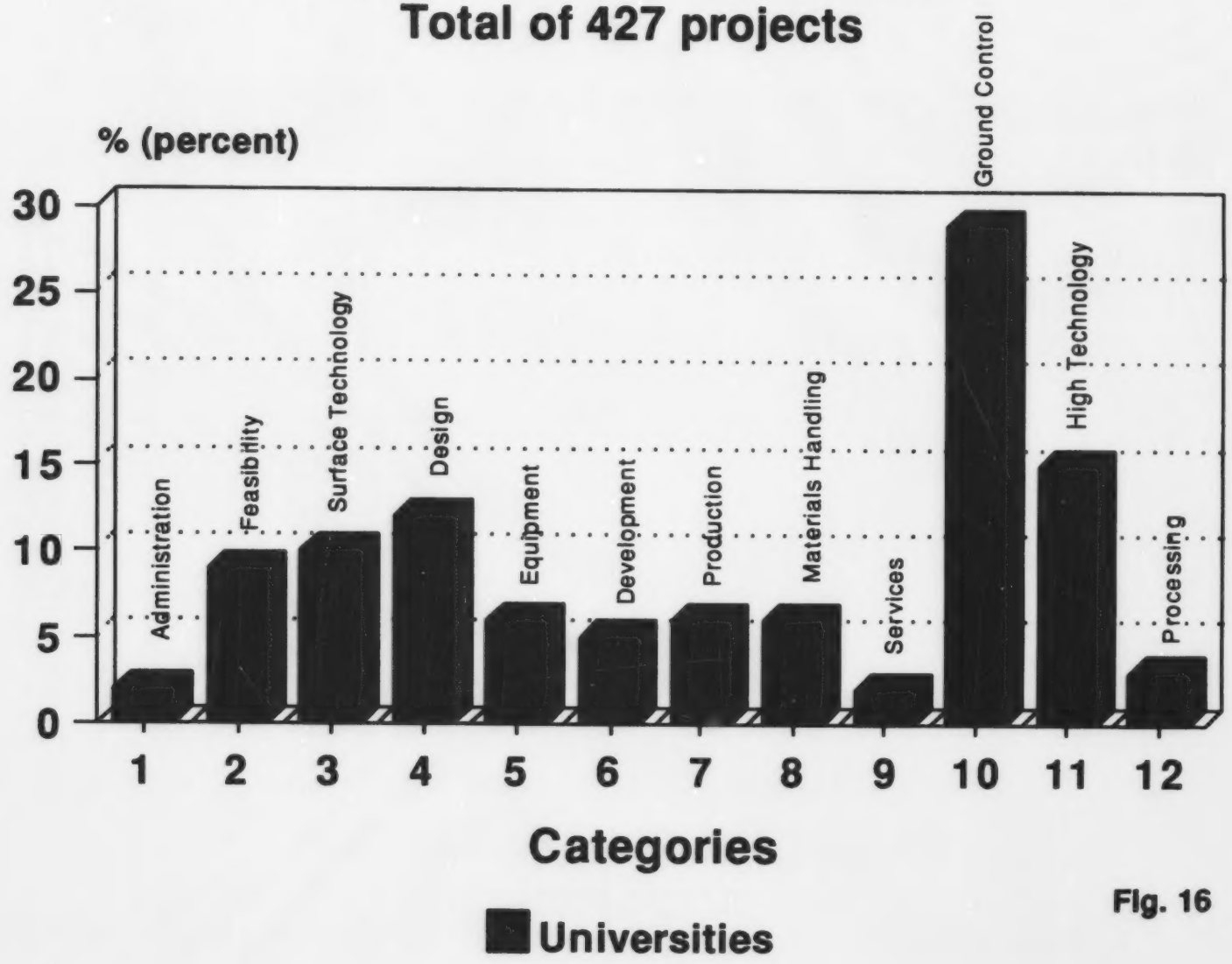


Fig. 16

PUBLIC SECTOR

PROJECTS BY CATEGORIES

Total of 140 projects

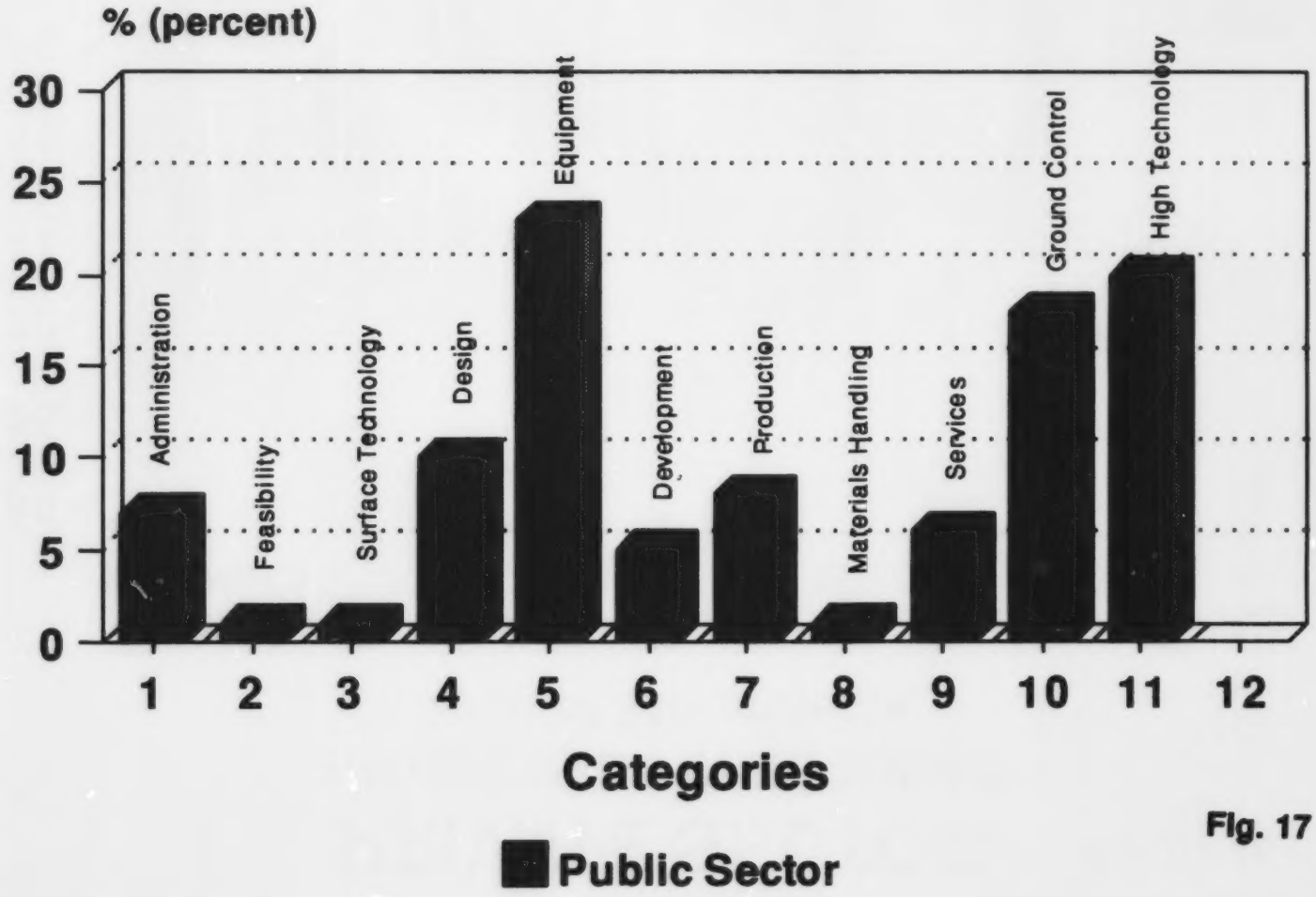


Fig. 17

PRIVATE SECTOR
PROJECTS BY CATEGORIES
Total of 340 projects

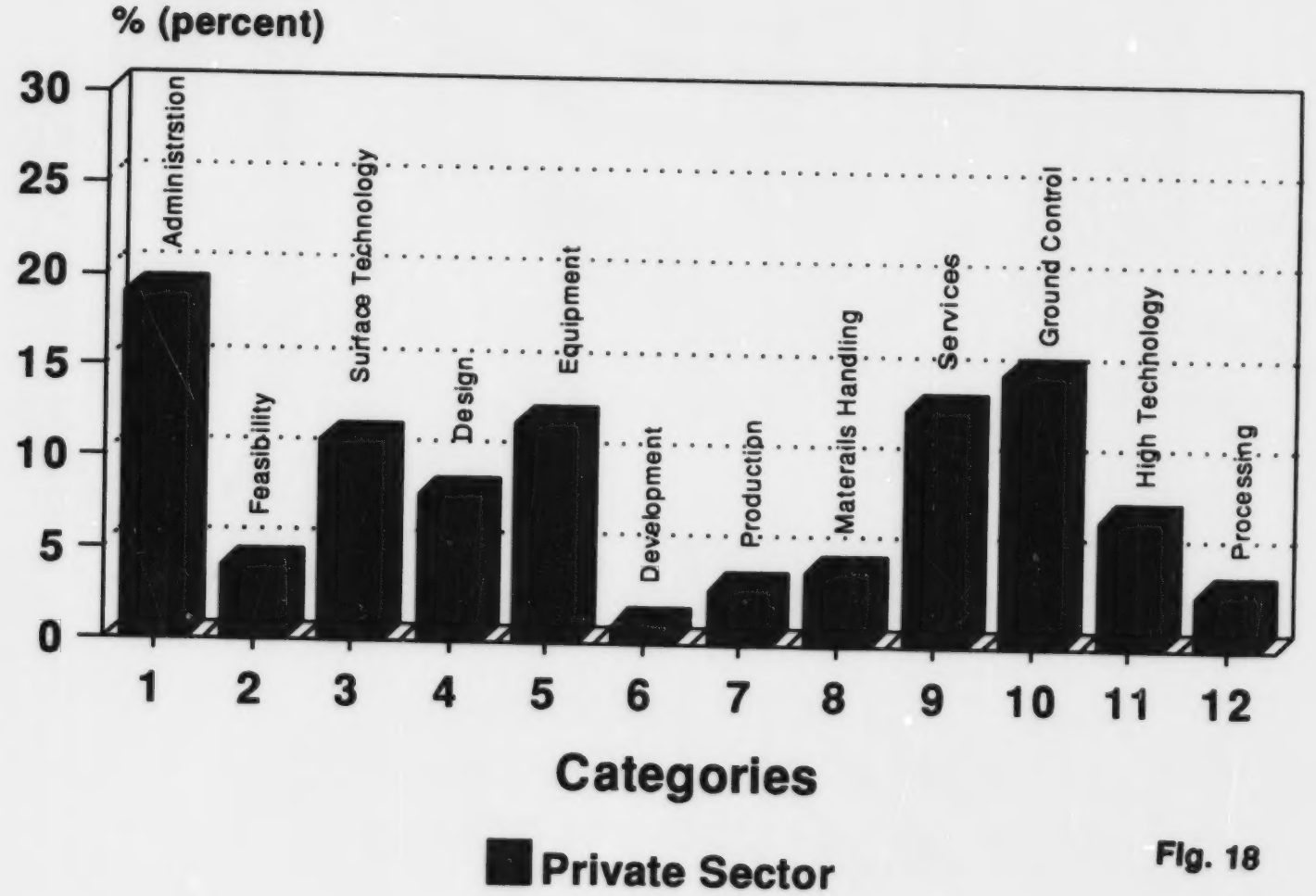


Fig. 18

MINING RESEARCH LABORATORIES

PROJECTS BY CATEGORIES

Total of 153 projects

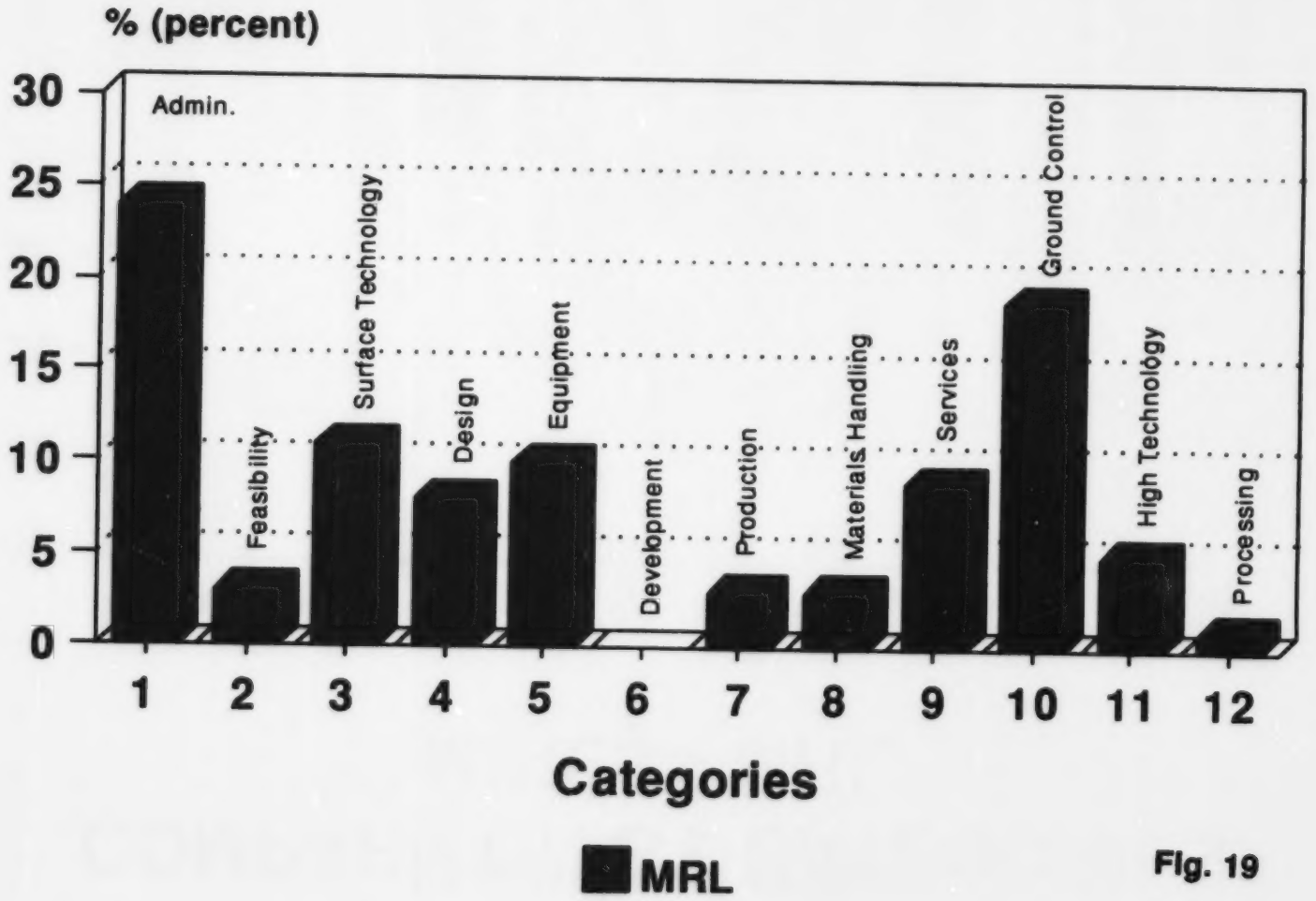


Fig. 19

COMPARISON BY CATEGORIES
MINES - MRL

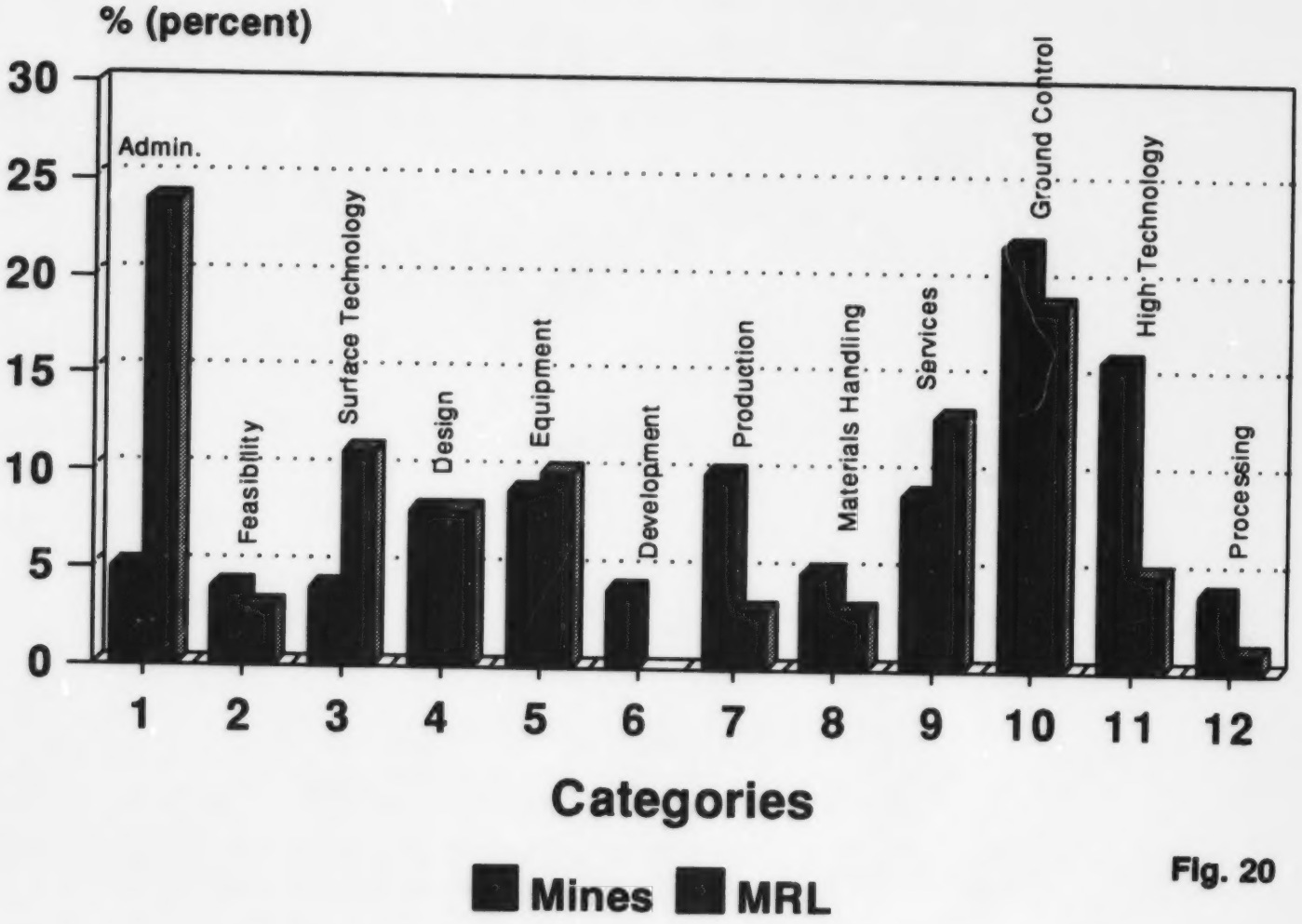


Fig. 20

COMPARISON BY CATEGORIES
UNIVERSITIES - MRL

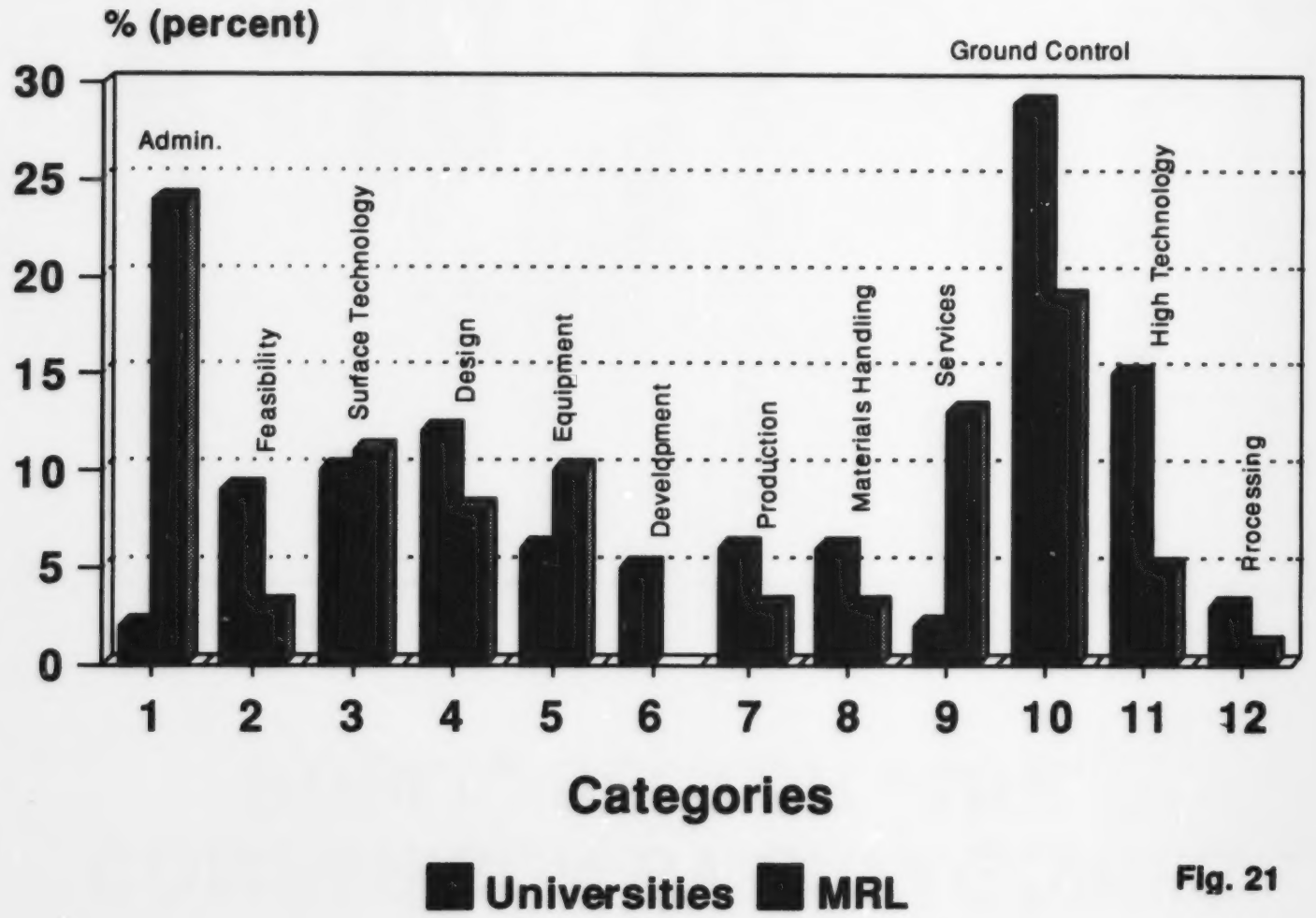


Fig. 21

COMPARISON BY CATAGORIES PUBLIC SECTOR - MRL

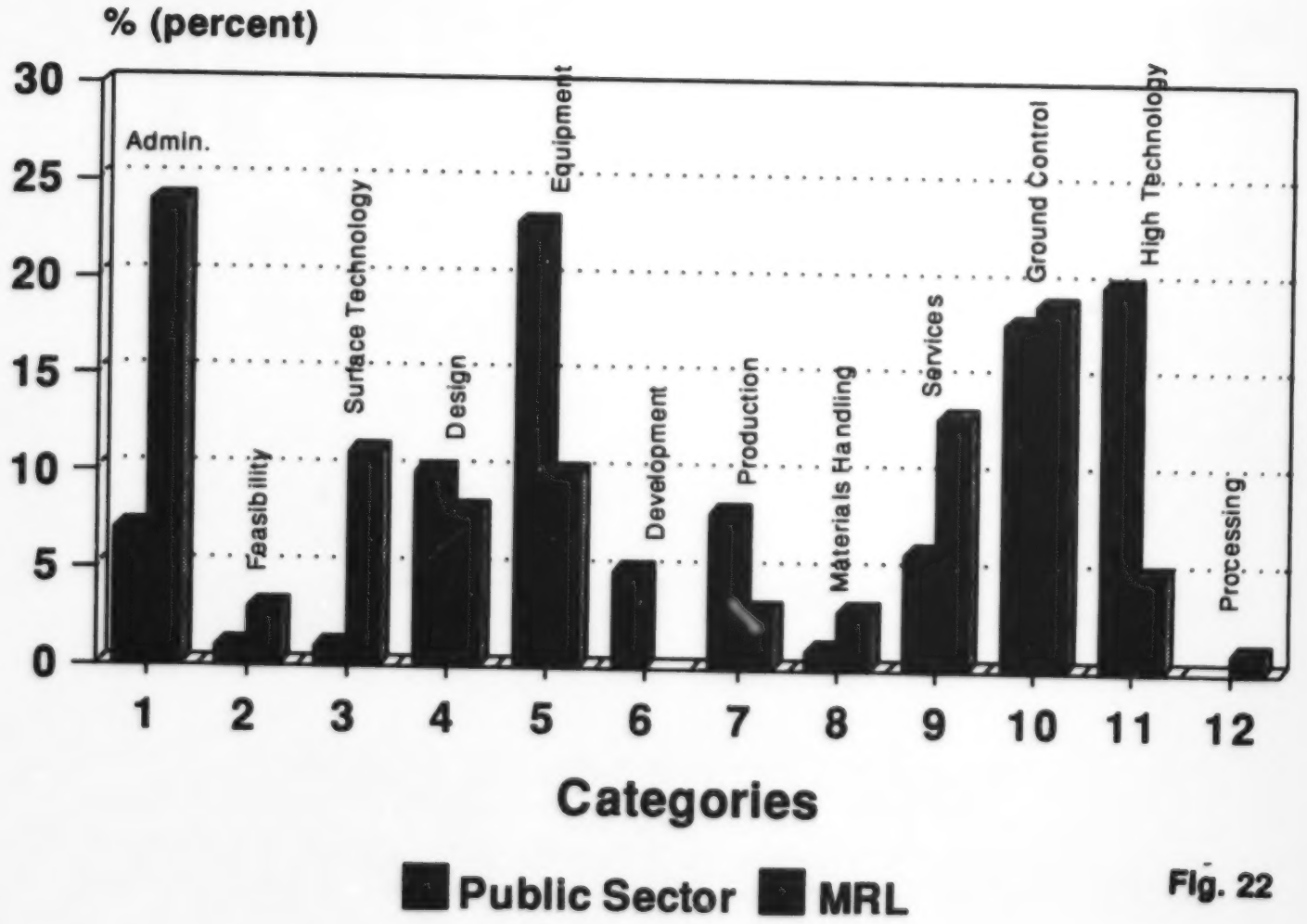


Fig. 22

COMPARISON BY CATEGORIES
PRIVATE SECTOR - MRL

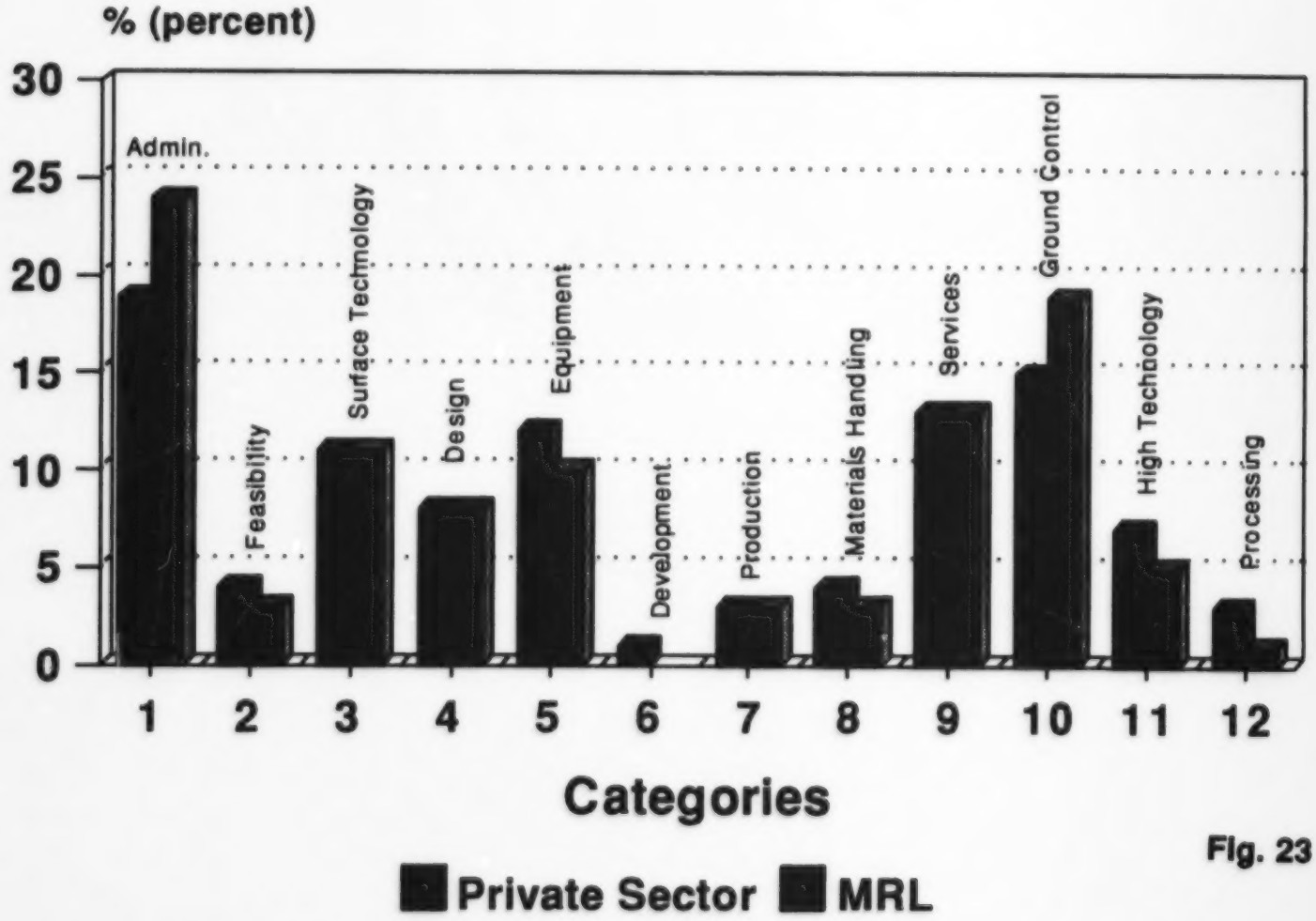


Fig. 23